What is claimed is:

1.   An   apparatus   for   online   signature   verification
analyzing a reference signature database (DB) of a specific
user, the apparatus comprising:
        a signature data input unit for digitalizing a locus
of a user signature and reading the digitized locus as a
sequence of points sampled at regular time intervals;
        a first pattern transform unit for performing a speed
equalization on the signature sequence read by the signature
data input unit and generating a first transformed pattern
sequence;
        a   second   pattern   transform   unit   for   performing   a
velocity transform on the signature sequence read by the
signature   data   input   unit   and   generating   a   second
transformed pattern sequence;
        a feature extraction unit for extracting three feature
vectors from the signature sequence read by the signature
data input unit, the first pattern sequence transformed by
the   first   pattern   transform   unit   and   the   second   pattern
sequence transformed by the second pattern transform unit,
respectively, to thereby generate the three feature vectors
having different information;
        a difference vector estimation unit for generating a
difference vector between the feature vector of the specific
user's reference signature read from the reference DB and
the feature vector extracted by the feature extraction unit;
and
        a determination unit for determining whether an input
signature and the reference signature are signed by a single
person, based on the difference vector generated from the
difference vector estimation unit.

2.   The apparatus of claim 1, wherein the first pattern
transform unit transforms the signature sequence read by the
signature   data · input   unit   and   generates   the   first

transformed pattern sequence, the transform being performed by using a following equation:

(Equation)

$$s_i = p_i \qquad\qquad i=1,2$$
$$s_i = s_{i-1} + (p_i - p_{i-1}) \qquad i=N-1,\ N$$
$$s_i = s_{i-1} + v\Delta t \cdot \Theta \qquad otherwise$$

wherein p_i, s_i, v, Δt, and Θ represent a point on an input signature pattern locus, an element of a transformed two-dimensional vector list, a velocity, a time interval between sample points, and a unit vector in the direction of Θ, i.e., in the locus at the point p_i, respectively.

3.   The apparatus of claim 1, wherein the second pattern transform unit transforms the signature sequence read by the signature data input unit and generates the second transformed pattern sequence, the transform being performed by using a following equation:

(Equation)

$$v_i = v_3 \qquad\qquad i=1,2$$
$$v_i = v_{N-2} \qquad\qquad i=N-1, N$$
$$v_i = (v_{xi},\ v_{yi}) \qquad otherwise$$

wherein the v_i is an element of the transformed two-dimensional vector list, and v_{xi} and v_{yi} are first horizontal and vertical derivatives at the point p_i on the input signature pattern locus.

4.   The apparatus of claim 1, wherein the speed equalization is a technique for recomposing a signature pattern based on an inverse proportional relation between a signature speed and a length of the pattern, and the velocity transform is a technique for transforming a spatial pattern into a velocity domain.

5.   A method for online signature verification analyzing a

reference signature DB of a specific user, the method comprising the steps of:

(a) digitalizing a locus of a user signature and reading the digitized locus as a sequence of points sampled at regular time intervals;

(b) performing a speed equalization on the signature sequence read in the step (a) to generate a first transformed pattern sequence;

(c) performing a velocity transform on the signature sequence read in the step (a) to generate a second transformed pattern sequence;

(d) extracting three characteristics vectors from the signature sequence read in the step (a), the first pattern sequence transformed in the step (b) and the second pattern sequence transformed in the step (c), respectively, to thereby generate three characteristics vectors having different information;

(e) generating a difference vector between the characteristics vector of the specific user's reference signature read from the reference signature DB and the characteristics vector extracted in the step (d); and

(f) determining whether an input signature and the reference signature are signed by a single person, based on the difference vector generated in the step (e).